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ABSTRACT

Three basic causes for the general decline in mathematics achievement among high school graduates nationally are poor motivation to learn math, poor math curriculum, and poor or no mathematics instruction. Many Native Americans drop mathematics because of lack of challenging courses or interesting teachers in their high schools. Since American Indians are often tracked into "vocational" programs requiring minimal math study, college work in mathematics and technical careers are closed to them. During the 1950's, efforts of universities to re-educate mathematics teachers from art, home economics, and shop teachers emphasized the improvement of mathematics knowledge, almost to the exclusion of instructional methods. Thus, students, taught by teachers who do not like mathematics, are bored with outdated calculation drills and ignore the algorithms of computer operation. When American Indian students, who have poor math achievement in middle and high school, do enter the university, they need remedial mathematics courses to survive. The stress of remedial work increases the possibility of dropout or certainly an extended time for degree completion. The status of mathematics teachers can be improved by: higher salaries; more efficient use of time; elementary and middle school math specialists who teach diagnostically; more current, relevant and interesting mathematics; computer based instruction. (NQA)

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Where Have All The Mathematics Teachers Gone?

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WHERE HAVE ALL THE MATHEMATICS TEACHERS GONE?

If the mathematical ability of entering freshmen continues to decline - as it has for the past 10 years - there soon will be a critical shortage of competent scientists and technologists (Trotter #1). Our world is dominated by science and mathematics. Computers simulate patients for medical diagnosis, plan home budgets and entertain the kids. The signs are here that America is falling behind in mathematics and science training.

As fewer students enter high school with the population drop, fewer are finishing as "math achievers." Analysis of scores on Standard Aptitude Tests (SAT), administered by the College Entrance Examination Board, documented a general decline in mathematics achievement among high school graduates nationally (Ford Foundation #2). One of three Native American students graduate from high school.

There are three basic causes in the decline of mathematics achievement in the United States.

1. Poor motivation to learn math.
2. Poor math curriculum.
3. Poor or no mathematics instruction.

The present shortage of qualified mathematics teachers is reaching crisis proportions. 7000 coaches were graduated in all of the U.S. south, but only 400 math teachers. The state of Maryland had 50,000 students being served in 1979-80

by 400 uncertified math teachers. In a 1981 study conducted by James Akin for the Association of School, College and University Staffing, he found 22% of the high school math teaching posts vacant. 26% of the math positions in the country are occupied by uncertified teachers, according to the National Council of Supervisors of Mathematics.

Minority students are frequently deficient in basic math. Rural and inter-city teaching has very poor appeal for most mathematics majors. Many Native Americans drop mathematics because they are not able to find challenging courses or interesting teachers in their high schools. Fifty (50) years ago, Indians were taught to be domestics and farmers. These occupations were thought to be the limits of our potential by missionaries and government people. When I visit high school counselors today, many will say there are no Indian students in their school with academic potential equal to the Stanford University challenge.

American Indians are often tracked into "vocational" programs requiring minimal math study. Without second year algebra and pre-calculus. Native American students will find college work in mathematics and technical careers closed to them. Even in the military, we are ill-equipped to operate, maintain, repair or build sophisticated weaponry.

Math teaching has never been a star in the education programs of the U.S. "Modern Mathematics," a curriculum revolution of the '60s, was a knee jerk response to Soviet adventurers in space. Federal programs provided the incentive for universities to retread (re-educate) mathematics teachers from art, home economics and shop teachers pressed into service during the '50s. The emphasis

was on improving mathematics knowledge almost to the exclusion of methods of instruction. Most programs were for high school teachers. Elementary mathematics teaching was not a high priority.

One result of the omission of elementary mathematics teachers from the retraining process was the hostile reaction of primary educators to this bizarre, mathematics curriculum of set terminology. It was often seen as one more educational fad to endure. The teachers least prepared for math curriculum change were asked to implement basic content and skill reform they had little hope of understanding. Many states do not require a mathematics course for elementary certification. I am please to note that New Mexico State University at Las Cruces is considering making mathematics methodology a degree requirement for elementary education majors where in the past it has been an elective.

It is a surprise that elementary teachers hardly comfortable with calculation, would avoid teaching topics like Geometry, Estimation Probability and Number Theory? Sets and vocabulary were seldom seen as the fabric on which all mathematics could be hung. Students were punished again by the tricks of mathematics language. Is it a subset or a proper subset?

Back to basics, advocates won the battle as social-economic need moved to less lofty jobs than space exploration. Test continued to show a loss of student calculation skills using traditional paper and pencil algorithms. This was enough for the death blow of "modern math" without any curriculum specialist noticing the advent of a electronic calculator-computer society. **Must we still teach people to ride horses in case the auto is out of gas?** If you work at McDonalds you will press

calculator words that describe the purchase. The computer tells you the cost of your purchase and the change. The operator has to have basic money number recognition skills to know how to make change. Now we bore our students with outdated calculation drills and ignore the algorithms of computer operation.

"Modern Math" will always be modern, changing and refined to meet our needs.

The big message lost in the first math revolution is . . . Math curriculum needs periodic revision and update. We are at this time teaching children to catch fish with their hands. There is a story in the Sabertooth curriculum where two opposing groups of Stone Age educators battle over the traditional hand catching of fish method being taught versus the new net and hook methods (#3). It was an early "Back to Basics" versus "Modern Math" struggle.

We are boring children to death with the tedium and frustration. No wonder few are inspired to become math teachers. The decision to teach mathematics is based more on the students experience with the subject than knowledge of the current job market. We are taught in elementary school by people who do not like math and have not been successful studying it. This is the model they present to motivate future math teachers.

Have you heard children say, "My mother/father hates math." They mean to say, I like my parents so I will probably be like them and hate math. I heard a kindergarden child say that he hated math. How would he know? Brothers and sisters establish for each other the belief that it is OK to hate math.

Teaching Mathematics Can Be Hazardous To Your Health

This label should appear on every math teaching contract. Each year teachers in high school are threatened, assaulted and insulted by students in the communities where they work. Poor pay and problems of discipline are compounded by non-teaching duties that drain individual teaching resources and cause teachers to leave the profession at an alarming rate. Business and industry offer salaries 2 and 3 times greater than teaching contracts for mathematics and computer instructors.

The struggle to teach an outdated curriculum with antique methods and materials is compounded by pressures for social promotion from subjective grading. How should grading be done? I believe the teacher should report what the student learns. It is not useful for a successful student's self concept as a math learner to continually remind them of their failures. An accurate record of skills, concepts and attitudes is necessary for diagnosing individual learning needs.

Parents are often treated as ignorant participants in the evaluation process, just another child in the 4th grade. We can underestimate their interest in the specifics of math learning.

How do you compete with television? Students today have been programmed for the humor of Hawkeye Pierce (M.A.S.H.) in 30-minute programs with commercials. They see more television before age 5 than the total hours they will spend in school to grade 12. Television is often a garbage dump of nonsense which gobbles up the creative juices of the visual producers in this country. Teachers are on stage. Most of us are not very good at it. Our script writers are underpaid or non-existent. The "respect" for what we do is at an all time low.

Instructional methods for mathematics are little respected by "serious" mathematicians. It takes a great deal of effort to begin to understand the learning process. It involves teaching techniques matched to individual personality. Medical doctor, psychologist and mathematician, the complete package for teaching today. Mathematics professors do not see their role as educators. They are protector of the sciences, screening out the undesirable non-math learner to preserve the purity of their fraternity (not unlike the Pythagoreans with their secret signs and symbols). They are researchers. Many future mathematics teachers are turned away by some college professors cutting remarks, "You should have learned that in high school," I answered that yesterday." All the successes and interest in a future of teaching, dissolved in the personal attack on one's ability to learn math.

The math teaching crisis has a serious effect on Native American education. Smile if you know a Native American mathematician, a computer specialist, or had a Native American math teacher? **We have very few role models.** Poor math achievement in middle school and high school excludes us from careers in technology. Women are particularly vulnerable to being classified out of the professions early with no mathematics background. Did I hear math is not feminine?

Most of us live or have grown up in rural areas and inter-city where good math teachers are hard to find and most likely not Indian. When we do enter the university, we need remedial mathematics courses to survive. In 1975-80, the number of college students enrolled in remedial math courses increased 70% (Harriet Stix #4). The stress of remedial work increases the possibility of drop out or certainly an extended time for degree completion.

The math clinic offers another learning structure that reduces the stress of remedial work. Self competition in the clinic saves wear and tear on your "successful math person" image.

I would like to offer a plan to improve the quality and quantity of Mathematics teaching available to all of us. Some of these solutions are immediate and temporary. Other actions will be long-term for a more thorough improvement in mathematics literacy.

Improve the Status of Mathematics Teachers Today by:

- A. Paying them higher salaries than other teachers. We need to compete with the supply and demand of industry.
- B. Use the teachers time more efficiently. Mathematics teachers should teach math only!
- C. Provide elementary and middle school math specialists who teach diagnostically. The university lecture professor is the worst of all teaching models.
- D. Develop working Mathematics Clinics for elementary, secondary and university settings to treat those students we have already made sick of math.
- E. Develop alternate instructional systems to support poor school districts

without adequate math teachers and curriculum. Video classes, computer instruction and mobile math clinics are possible.

LONG TERM WE WILL NEED TO SERIOUSLY ADDRESS:

1. Curriculum Development:

- A. Students need to take more mathematics that is current, relevant and interesting. These courses will have to be designed with community interest, learning behaviors and state of the art math content.
- B. Computer based instruction requires many hours of design for each hour of class presentation. The computer will provide a new methodology for individualized instruction. It has the marvelous ability to have instant learning re-enforcement, and recall, all the students processes in learning a skill or concept. The computer and calculator have impacted what we teach. It is time to discard the interesting, but not critical knowledge for a relevant math content.
- C. Problem posing, as well as solving, is the skill of our future. Back to basics is dead. Long live the logical thinker, problem poser and solver.

2. Teacher Preparation:

- A. At the elementary level, we need to require more mathematics for certification.

- B. Pay math specialists to justify an expectation that elementary mathematics specialists will be certified in mathematics.
- C. Federal, state and university leaders need to target the elementary teacher in the next National Science Foundation type study grants.
- D. High schools need mathematics curriculum reform. If $\frac{1}{2}\%$ of the operations budget was spent for mathematics curriculum design, we might get nearer to knowing what we are teaching. High school mathematics teachers need the content study of the National Science Foundation grants of the 1960's with a strong balance of methodology.
- E. University professors who teach well should be paid and rewarded equally with the researchers. Workshops in methodology should be required to meet the same certification standards of other teaching levels. We must begin to teach all students in the university to the highest level of achievement a persons interest and ability will permit.

There is a personal learning of mathematics commitment each American Indian individual must make. No teacher can teach what you are not ready to learn. Through effort and success in mathematics study, will have influence and immortality beyond our age. You maybe a better mathematics teacher for those future students who will depend on math for survival.

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